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ABSTRACT

Pupils' natural questioning attitudes lead them to discovery in a learning center, in contrast to the lecture method, by which information is forced on students regardless of their interests. This paper describes learning experiences built around rocks. Materials placed in a rock center (rocks, stones, pebbles, magnifying glasses hammers, and materials to scratch and be scratched) encourage students to explore. Students work at the level of their ability and understanding, but each can find some activity that will help them learn about rocks. The processes of learning, however, go beyond initial stimulus and response. After preliminary experiences with the specimens, students proceed to enrich the materials and expand the activities of the center, gathering books and source materials, collecting rock samples, investigating the composition of stone buildings, examining dam construction, and studying road building. Many of the student investigations develop skills that can be transferred to other subjects: obviously reading and math, but also earth sciences, history, geography, ecology, and architecture, among others. Stones in language from "stone cold hearts" to "rock and roll," stones as art materials, and the language of geology are corollary studies. Any simple subject approached as a discovery experience can serve as a springboard to multi-faceted learning. (DHP)

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Using Rocks: A Discovery Approach to Multi-faceted Learning

by

John I. Thomas

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College of Education

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Plymouth Rock, Mt. Rushmore, the Rosetta Stone, the Great Wall of China, Easter Island, Gibraltar, Stonehenge, Camelback Mountain, the City of Rocks, Jerusalem's Wailing Wall, the Blarney Stone -- rocks that intrigue and pique the interest of children. People, places, and events! Place rock specimens and pictures of these in a rock center. What stories might they tell? History, geography, and earth science come into view. Maps are explored, location skills are developed, and history is recaptured by your pupils. Is there a more unique way to multi-faceted learning than through personal discovery?

In my classrooms, I found it intriguing to watch my elementary pupils function at a learning center in which I had placed squares of glass, pennies, portions of porcelain tile, magnifying glasses, a hammer, and rock specimens for them to discover what they could about the specimens. Other than an open-ended question on a placard used to attract pupils and initiate action: "What can you find out about these rocks?," no directions were given to the pupils on how they were to proceed. Almost immediately, those attracted to the center were observed to pick up the magnifying glasses to study the specimens, hold diaphaneous rocks to the light, pick up pennies to scratch the samples, use their fingernails similarly, scratch rock against rock, use the hammer to chip off pieces, record the color, feel, and shape of the rocks, weigh the various specimewns in their hands, rub them on the porcelain tiles, scratch the rocks against

the plates of glass and the glass plates against the rocks, all the while engaging each other in conversation on what their experimentation revealed to them.

I'd like to think that the natural questioning attitudes of the pupils had led them to discovery learning through the opportunity presented in the learning center. I can readily imagine each of my pupils confronting the materials in the center and asking, "I wonder why the glass plate, porcelain, magnifying glass, and penny are here. Can I somehow make use of them? These rocks look different. Is there some way I can lump those that look alike together? And if I do, will I find something out?" The almost immediate result was that the pupils developed their own classification system through their individual procedures, yet emerged with many of the same observations as those made by professionals in the field. Their observations, for example, that rock specimens vary in hardness, cleavage, feel, diaphaneity, shape, composition, and streak are much the same as those of geologists and mineralogists.

Contrast this approach with that used in my earlier teaching days which invariably took the pattern, "Today, boys and girls (the entire class, no less!), we are going to learn how to classify rocks and minerals, first by determining the hardness of each, then by ...." This was done in spite of the individual interests expressed by my pupils.

The learning center approach to discovery went beyond the initial stimulus and response. Within hours of their experiences with the rock and mineral specimens, my pupils proceeded to enrich the materials and expand the activities of the center. They gathered books and source materials for further exploration, collected rock samples, investigated the composition of buildings made of stone, looked into the production of cement, observed the construction of a dam, and studied the way roads used to be laid and how they are now. From this start, some of the pupils went into a more extensive study of the earth sciences.

You can carry this further. Consider still other experiments that can be done with rocks, stones, and pebbles. Place a variety of stones and other appropriate materials at a "rock center." Encourage your pupils to experiment with different sizes and shapes. Let them find out dissimilarities in the volume and weight of the stones. Rather than describe the procedures that are necessary, place a tape measure, containers of water, and empty containers and basins in the center. Invariably, I think you will discover that your pupils will develop their own strategies for accomplishing this task, no matter what their grade level. Some of your pupils will take it upon themselves to measure the length, width, and circumference of the different rocks with the tape measure you have provided in the center. Others will likely experiment with principles of displacement by dropping rocks into a

container of water and measuring the differences in the rise of the water to determine which speciments are heavier and lighter. Still other pupils may catch and measure the extent of water spillover. The very youngest may simply arrange stones in order of size to determine the smallest to largest. Consequently, you can expect most of your pupils to be involved with counting, seriating, estimating, weighing, and measuring.

Contrast this approach to arithmetic with the textbook approach. Note that much more than arithmetic is involved. Pupils inquire, investigate, infer, and invent. They also discover, diverge, and demonstrate. Continuous evaluation takes place as they group, sort and classify, deriving scientific concepts and generalizations in the process of their discoveries.

Do rocks sink or float? If the former, what is the rate of descent? Do rocks burn? Change color? Crumble? How are fossils imprinted in the rocks? Why are rocks different colors? Where does soil come from? Can you make soil here at the learning center? Why is the color of desert sand different from that of the soil in the mountain? Children find a natural outlet to the study of geology, the study of the earth on which they live, and the plant and animal life which sustain it. Imagine, if you will, the quantity of the self-directed activities you can expect to emanate from their inquiries. There is simply no end to the possibilities. Natural transitions to the study of

geography, history, ecology, and man-made shelters and edifices are likely to be made by your pupils.

Extend the "rock center" further. Encourage your pupils to search for and create expressions which involve rocks and stones. Help them to get started by listing a few idioms, phrases, and sentences. Expressions such as "stone cold," "rock bottom," "heart of stone," and "a stone's throw from here" may be enough to stimulate pupils to search the literature and invent brand-new expressions to be added to the list, thus enriching their language and possibly leading to further exploration of colloquial and dialectical speech patterns, and the study of the people who use them. Who are the people who use such expressions as "a stone's throw from here"? Where do they live? What do they do? Do they go to schools similar to ours? What is the origin of the expression? This is a fascinating approach to the study of people. Present your pupils with other expressions to reflect upon. "Sticks and stones may break my bones," "Rolling stones gather no moss," "Gravel Gertie," "hard-rock music," "rock and roll." Your pupils are likely to explore the origins and meaning of each of these enthusiastically.

The "rock expressions" formulated may be artistically enriched. Paint a rock face! Create an animal! Construct an insect! Place plaster of paris, paints and brushes, and materials such as pipe cleaners in the center. Invite your pupils to create and construct new forms of animals, insects, plants, and mosaics out of the stones available.

Or, for those who wish, encourage their making fossil imprints.

Extend the rock center further. The vocabulary development of your pupils is a natural consequence of their contact with stones at the center. Your pupils will explore size, texture, color, cleavage, and shape, as well as comparatives (heavier, smoother, lighter, shorter, longer, rougher than). Encourage pupils making use of the center to develop and extend the vocabulary associated with characteristics of the stones.

A representative list might include:

Size	Texture	Color	Cleavage	Shape	Other
large	soft	white	straight	pointed	opaque
small	rough	rose	curved	regular	translucent
area	smooth	yellow	break	uniform	transparent
measure	rounded	red	plane	proportionate	heavy
volume	sharp	black	sever	symmetrical	light
diameter	crumbly	brown	split	flat	porous
magnitude	silky	pink	fracture	round	igneous
mass	greasy	gold	well-defined	cube	sedimentary
dimensions	composition	silver		cylinder	metamorphic
tiny	arrangement	copper		oblong	basalt
little	structure	green			erosion
	grain				strata

Most children enjoy discovery-type learning experiences. Some of your pupils, however, will likely prefer and need to be directed by you. Thus, instead of encouraging them to discover on their own at a rock center, your initial lesson plan to involve them in learning experiences built around rocks might assume this pattern.

ROCKS! ROCKS! ROCKS!

Note the rocks in this center. Pick them up. Look at each carefully. Any one of these is either an igneous (IG-nee-uhs), a sedimentary (sed-uh-MENT-uh-ree), or a metamorphic (met-uh-MAWR-fik) rock. To learn which is which, do the following:

1. Select one rock
   a. Does it look glossy?
   b. Is it made of shiny grains?
   c. Do you see streaks or "veins" running through it?
   d. Can you see crystals in it?

   If you can answer yes to each of these questions, you probably have found an igneous rock. If you are not sure of your answers...

2. Look at the rock again
   a. Is it made up of layers?
   b. Does it look like hard clay?
   c. Is it soft enough for you to scratch with a penny?
   d. Does it split into thin pieces?
   e. Is it brown, or red, or black, or grey, or white?

   If you can answer yes to each of these questions, you probably have found a sedimentary rock. If not commpletely satified with you answers...

3. Look at the rock once again
   a. Is it real hard? So hard that you can't scratch it with a penny?
   b. Does it have many colors?
   c. Can you see shiney bands or streaks of black and white running through it?

   If you can answer yes to each of these questions, you probobly have found a metamorphic rock.

Now, how many of the rocks can you identify as igneous, sedimentary, or metamorphic? Show me when you see me free. What kinds of rocks can you bring in to help our rock center grow?

Similarly, learning centers may be created with other natural objects and the various throw-away or discarded items you have collected. Many approaches to learning are invited. In a "button and bead" center, pupils may classify buttons according to size, color, shape, and number of holes, or may design patterns of beads. In a "bottle and lid" center composed of assorted bottles, jars, and lids, they may be given opportunities to match and screw lids to the appropriate bottles and jars.

Your pupils have cellophane to crinkle, newspapers to crunch, magazines to cut up, and objects to touch, smell, taste, hear, and see. They classify smells and tastes, describe sounds and sights. They wonder, imagine, and ask questions. What can I make with the clay? What can I build with the sticks and twigs? Sticks, poles, and logs? How many ways can they be used? Read to find out. They read about spears, bows and arrows, tipi frames, log cabins, rafts, baseball bats, dugout canoes, ships' masts, fence posts, telephone poles, parking signs, brooms, fishing rods, "witches" on stakes, Joan D'Arc burned at the stake!

In short, a simple set of rocks when approached as a discovery experience, is likely to serve as a springboard to multi-faceted learning centered on acquiring new information, developing useful skills, and exciting the imagination and creative expression of pupils.